

# Thought and Reality

## A Philosophical Conjecture About Some Fundamental Features of Human Thinking

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**Abstract** Trying to understand how thinking works cannot be separated from trying to understand how reality works. A recent approach to understanding how reality actually “takes place” postulates two complementary aspects. There is a “factual aspect of reality” which is characterized by well-defined predications, causal closure, and local spacetime. But there is a complementary, “statu-nascendi” aspect of reality which addresses how facts, and with them local spacetime, come into being in the first place. This aspect of reality is inherently constellatory, i.e. the constellations of components are the most basic phenomena – somewhat similar to Gestalt phenomena in the visual domain. Human thinking is interpreted as a highly advanced cognitive adaptation to this irreducible Janus-headedness of reality. In parts it can be well defined, in parts it just cannot – because it must leave room for the on-going self-unfolding of meaning. This self-unfolding of meaning is interpreted as the most accurate semantic approximation to the ongoing self-unfolding of reality. It is, thus, not a *bug* but a crucial *feature* of complex thinking. Unlike formal languages, which structurally correspond to the factual aspect of reality, natural language is capable of dealing with both aspects of reality: its facticity and its coming into being.

### 1 Introduction

Human thinking is probably the most complex process in the universe. But, very much like the phenomenon of time in which we are also comprehensively embedded in our existence, it is both extremely close to us, and also extremely difficult to grasp conceptually.

To strive for a better understanding of human thinking has at least four rather distinct motivations:

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- as a pinnacle of evolution it is a most fascinating issue for scientific scrutiny in itself,
- as a highly distinctive feature it sheds light on who we are, i.e. on the question “what makes us human?”,
- as a competence it is quintessential for coping with the challenges of an increasingly complex world,
- as a production factor it becomes the key value generation process in a knowledge-based economy.

We are far away from understanding how human thinking actually works. A state-of-the-art answer to these questions must integrate insights from at least two rather heterogeneous approaches: the age-old philosophical quest for thinking and its relation to reality, and the more recent insights from cognitive neuroscience (including cognitive psychology, neuroinformatics and evolutionary anthropology). In the Parmenides Center for the Study of Thinking we are working towards such a “bipedal” theory of thinking.

The present paper introduces a philosophical conjecture about the relation between thinking and reality. The general approach is to interpret the human faculty of complex thinking as the most advanced adaptation of cognitive evolution to the way reality works.

It is a very good and successful tradition in science to try to address one issue at a time. I apologize for not following this commendable habit in this article, but there seems to be a compelling reason. I am convinced that complex thinking is – at least to a very large extent – a successful phylogenetic adaptation to the way reality actually works. (If thinking would consist predominantly of “confabulations” that have nothing to do with what is actually going on “out there”, it would never have survived the pressures of evolutionary selection.) So, I see the conscious experience and cognition of human beings as the hitherto most advanced and most sophisticated way of coping with reality – as it actually is. If this assumption is right, it means that to understand how reality works is a prerequisite for understanding how thinking works – as the latter is, to a large extent, an evolutionary adaptation of the first.

And here the problem begins: At the most fundamental level we do not have a clue in modern science how reality works. Classical physics, and by this I mean Newtonian mechanics, Maxwell’s electrodynamics and both, special and general relativity, is an extremely successful family of theories. But, eventually they all imply a comprehensively determined block universe in which nothing genuinely novel can happen, and in which the experience of time and especially the experience of a present are basically subjective confabulations, the “sticky illusion” Einstein was referring to.

On the other hand we have quantum physics. Its predictions have been proven right with even higher accuracy than the other three theories together. But there is no generally accepted interpretation of what quantum physics tells us about reality. Some opt for a quasi-classical interpretation, avoiding genuine novelty, but e.g. at the cost of an unimaginable inflation of the number of universes at every single moment in time (as each possibility gets realized its own universe). Although this position cannot be proven to be wrong *within* physics, I think it is highly questionable on philosophical grounds and, even more important, it is, at least for me,

“just too ugly to be true”. The other camp believes that the future is open, i.e. that the reduction of state is a meaningful process that really takes place. This position, however, implies a full-fledged contradiction between general relativity and quantum physics – right at the most fundamental level of our understanding of reality.

Working since three decades on both, our understanding of time and reality on the one hand, and on the question, how thinking works, on the other, I come to the conclusion that we cannot really separate and isolate the two issues from one another: we will not be able to answer the second question without significant progress regarding the first – and vice versa.

For this reason the present article begins with a short summary of ongoing own work on a modified account of time and reality (see Literature). The main difference to the traditional view is that it assumes a complex notion of time in which the linear sequential character is just one of two aspects. The other, orthogonal, aspect is an expanded timespace of the present – in which the genuinely novel can occur. Only via this taking place of reality in the timespace of the present, facts materialize – and with them local spacetime starts to become applicable. In a nutshell, this approach claims two complementary aspects of reality: facticity on the one hand (successfully addressed by the family classical theories) and the “taking place of reality as such” on the other, addressed by quantum physics. Human cognition, and especially complex thinking, is seen as a successful adaptation to *both* aspects of reality and time – and understanding it requires, therefore, to start with looking at “how time and reality work”.

Based on these foundational considerations about reality, one can then ask how thinking actually works. And there we see that both, the basic architecture of human thinking and many of its characteristic features become understandable as efficient and successful adaptations to this Janus-faced reality.

## 2 A Brief Summary of a Novel Account of Time and Reality

Time is until today probably the most mysterious of the fundamental concepts, both in philosophy and physics. Yet, de facto there is a broad implicit consensus. It holds that the primary feature of time is to provide – one way or the other – what we perceive as the sequential order of events. This is even common ground between relativity and quantum physics.

In the following a fundamentally different way to think about time is developed: The sequential structure is introduced only as a complementary, but in a way even derivative feature. The primary feature of time is to provide an expanded, but not yet sequentially structured temporal platform which constitutes the “stage” on which everything that is takes place. This stage is the “time-space of the present” – in which everything that is, comes into being. Only as facts materialize – on that stage, a prior starts to separate from a later and the sequential aspect of time starts to unfold. *The sequential notion of time applies, therefore, only to the factual aspect of reality.*

This notion of time differs profoundly from “presentism” according to which only the present exists, but in which this present is again conceptualized within the framework of a linear sequential time. Here, instead, both, the timespace of the

present and the sequential aspect of time (with past, point-like now and future) are complementary aspects of the taking place of reality. The present is no longer reduced to a point-like now; it is expanded, but this expandedness is “orthogonal” to the linear sequential aspect of time. Due to its orthogonality the present can now also play an objective role in physics, which is needed for understanding e.g. the state reduction as the occurrence of something genuinely novel (which is inconceivable in a purely classical or relativistic conceptual framework).

Only via this primordial “taking place” in the timespace of the present, what occurs becomes a fact – and only by doing so it gains its well-defined position in local spacetime. What occurs is “taking (its) place” in local spacetime in the most literal sense.

Natural laws assure the constitutive continuity of the factual aspect of reality. Their predictive power is a function of this – but also limited to it. In this way, the comprehensive determinacy of the factual aspect of reality, the “block universe” of relativity, becomes compatible with the objective indeterminacy i.e. the occurrence of something genuinely novel in the state reduction of quantum physics.

These are two complementary aspects of reality: Quantum physics addresses the taking place of reality – in the – not yet sequentially structured – time space of the present and this implies genuine novelty. Classical and relativistic physics, instead, are focused on the factual aspect of reality. Facticity and spacetime locality are functionally equivalent notions.

Neither of these two views allows for a comprehensive description of reality: “Measurement”, the (asymptotic) transition from a coherent to a decoherent state implies – and requires – (asymptotic) facticity. On the other hand, the inevitability of singularities in general relativity shows that the fabric of local spacetime also cannot be thought of as an all-encompassing canvas – respectively that facticity cannot be the only aspect for describing reality.

In this new account of time and reality our human perception of a present is no longer pushed aside as a subject-side confabulation that has no role in physics (a fact that Einstein deplored explicitly in his discussion with Carnap). In evolutionary terms, such a costly, but dysfunctional distortion could not have survived the pressures of evolutionary selection. Instead, the experience of the present – inseparably linked to the phenomenon of consciousness – is seen as the hitherto most advanced form of higher cognition. Together with the (orthogonal) perception of the factual aspect of reality, it allows for a much richer and more accurate perception of the way in which reality actually takes place.

In this vein it is argued

- that the classical and relativistic physics deal primarily with the factual aspect of reality and that, therefore, the sequential notion of time is sufficient – at least to a large extent,
- that quantum physics, instead, addresses essentially how facts come into being in the first place – and, therefore, requires a much richer notion of time and reality,
- that the mathematical apparatus of quantum physics implicitly anticipates already much of both, a radically different, present-centered notion of time and the related, significantly richer notion of reality,

- that the discrepancy between classico-relativistic and quantum physics cannot be overcome by just quantizing gravity, but that we need to go back to the conceptual drawing board and to make their categorial foundations part of our physical theories.

All scientific theories are based on categorial foundations. Categories are the most basic patterns of thought that shape and constrain all we can think. Unlike hitherto assumed, these most basic structures of thought do not come in isolation but as categorial frameworks that are characterized by strong internal interdependencies. Classical and relativistic physics are based on a categorial framework that consists of four interdependent components:

- a *Boolean predication* space characterized by the principle of “tertium non datur”,
- the *linear sequential notion of time* with a no-longer present past, a point-like now, and a not-yet present future,
- the *principle of causality* in the sense of causal closure according to which for anything that happens a sufficient cause exists,
- the *subject/object dichotomy* according to which there exists a clear-cut distinction between observer and observandum.

None of these four components can be dropped without destabilizing all others. They constitute an integral and coherent categorial apparatus. The common denominator of this categorial framework is comprehensive separability. This framework eventually implies a block universe and it applies to the factual aspect of reality – and only to it. Facts, however, are only the traces left behind by the taking place of reality. Quantum physics, instead, addresses also how facts come into being in the first place. For addressing also this prefactual or “statu-nascendi” aspect of reality a profoundly different, second categorial apparatus is needed, in addition. It consists again of four interrelated components that cover the same four functional slots; (a) the structure of the predication space, (b) a notion of time, (c) a pattern how events are linked, and (d) a basic epistemological setting.

In case of the second categorial apparatus these four constituents are

- a *paratactical predication space* allowing for constellations of propositions, but without the possibility of logical conclusions,
- the *timespace of the present* as an expanded, but not yet sequentially structured temporal platform on which reality takes place,
- the principle of *autogenetic unfolding* according to which something “becomes what it is”, in the absence of external causation,
- the structure of *strong selfreferentiality* which appears whenever something refers to itself in its entirety.

Taken in isolation and projected against the rest of the first, the “classical” categorial framework, each of these four components leads immediately to inconsistencies. Taken together, however, they form a second, categorial apparatus in its own right – which is again inherently consistent. This second framework is complementary to the first and allows addressing the taking place of reality – as it actually occurs, i.e. in the time-space of the present. If something genuinely novel comes into being this cannot occur in the

past or the future. It can only occur in the present, and, therefore, genuine novelty implies an “objective role” for the present.

This “objective present”, however, is not in contradiction with relativity. In the framework where it belongs, i.e. in the second categorial apparatus, it doesn’t define a specific, point-like now that would be mandatory for the entire universe. Instead, as an “orthogonal” feature of time in its own right, its inseparable expandedness can “host” all possible now’s – and the related paratactical predication assures that “contradicting” predications are just constellations of ascribing “a” and “non a” – co-existing in the same, expanded time-space. Due to the absence of formal conclusions in paratactic predication, these superposition states do not lead to the “ex-falso-quodlibet catastrophe” that they would imply in a Boolean predication space.

The four big “enigmas” of quantum physics, entanglement, superposition, uncertainty and objective indeterminacy, are the foot-print of the statu-nascendi aspect of reality – for which the second categorial apparatus is required. Only if we project this taking place of reality – erroneously – already against the categorial apparatus that belongs to the factual aspect of reality, these four features become “enigmas” and conceptually insurmountable problems.

Up to now one was not aware of the existence and the crucial role of these underlying categorial frameworks. Therefore, one tried to give up or modify elements of the first framework in isolation, e.g. by giving up causality for state reduction but continuing to work with linear sequential time as if nothing had happened. This resulted not only in the well-known “enigmas” of quantum physics, but it also created the hitherto unsolvable contradictions between quantum physics and general relativity.

These discrepancies, however, do not constitute fatal inconsistencies. They are the logical consequence of the phenomenon that classico-relativistic and quantum physics focus on different aspect of reality: the first on the factual aspect of reality, the latter on how facts come into being in the first place.

Only by gaining insight into the fundamental difference of these two complementary aspects of reality, and by applying the appropriate categorial framework, we will become able to overcome this essential rift of modern physics. This, however, requires that we dig still one layer deeper and to make their categorial underpinnings part of our physical theories.

### **3 Human Thinking as an Adaptation to a Janus-Headed Reality**

If reality is inherently characterized by these two complementary aspects, facticity and statu-nascendi, human thinking – as the phylogenetically most advanced form of cognition – is likely to be structurally adapted and tuned to this “Janus-headedness” of reality.

There should be one set of cognitive processes that enable us to deal with the factual aspect of reality, and this are the well-defined or well-definable “ratiomorphic” operations. Instead, for the inherently self-referential and autogenetic aspect

of reality, i.e. reality in *statu-nascendi*, well-defined operations are structurally inadequate. In order to come grips with this – not epistemic, but ontic – incompleteness and uncertainty we have to look for profoundly different mechanisms, for which I use the notion “logic of constellations”.

Sine Aristotle’s great effort to define the rules of thinking “in abstracto” most of the history of “logic” focused on abstract rules for correct concluding. Heraclites, instead, had still a much richer notion of logic. For him “logos” was the overarching and all pervading principle according to which all of reality unfolds. Only Hegel formulated, more than 2000 years later, a similarly rich and encompassing notion of logic.

Based on what we saw regarding the Janus-headedness of reality, the reduction of logic to rules of formal correctness is definitively too narrow. It only covers the needs of the factual aspect of reality. The *statu-nascendi* aspect, instead, corresponds as we saw to a paratactical predication space. The “logic of constellations” describes what happens in a paratactical predication space, i.e. how *meaning unfolds* in constellations of semantically already meaningful components (e.g. words, concepts or propositions – but, in the case of art, also well beyond the domain of language).

Asking how this unfolding of meaning actually occurs, I propose to identify three closely interrelated, but nevertheless distinguishable dynamics.

- the first is the mutual interpretation of the components of the constellation, i.e. the “horizontal” dimension in the autogenetic unfolding of meaning.
- the second is an emergent “overarching meaning” of the entire constellation which constitutes, so to speak, “vertically” out of and above all the horizontal semantic dynamics.
- the third, finally, is a top-down reinterpretation, in which the emergent meaning of the whole impacts back on its own constituents.

These three dynamics play together and constitute an on-going unfolding of meaning that, for principle reasons, is never finished. It may, however, converge asymptotically, in which case we can get to a rather clear – although never fully well-defined picture. It may also diverge, in which case we cannot come to grips with the issue, even if we draw on constellatory logic.

In experiencing art, I would argue, this constellatory logic inevitable plays a major role. The way in which a poem “unfolds” its meaning for us can serve as a good example for the three dynamics mentioned above:

- A poem is a constellation of words. A first effect of this is that all the words shed mutually light on each other, i.e. interpret and reinterpret each other mutually. (For this reason there aren’t two poems in which exactly the same “moon” would shine.) It is characteristic for a poem that the words that constitute it continue to unfold their meaning in and via their specific constellation.
- A second effect is that – out of this “horizontal” semantic dynamics that occurs between the individual notions that constitute the poem – an overall meaning emerges “vertically”. This emergent over-all meaning can never be comprehensively defined, due to the ongoing “horizontal” dynamics from which it results. The emergent meaning can in some cases remain extremely ambiguous or

opaque. But, exactly this ambiguity or opaqueness is, in this case, the overarching impression that emerges.

- The third dynamics, finally, concerns the “feed-back” of this emergent overarching meaning upon its own constituents. Contrary to the prior, this is not a “bottom-up”, but a kind of “top-down” dynamics – in which the overarching meaning that emerged now impacts back on its own constituent components, the meaning of the individual words and the dynamics that occur between them.

The unfolding of the meaning of a poem is in this way a highly selfreferential, and thus autogenetic, process. What has been called “logic of constellations” is the trial to understand how this unfolding actually takes place – in a paratactic predication space and drawing on these three underlying dynamics.

The next question is whether there is any phenomenological evidence from cognitive psychology or cognitive neuroscience that would correspond to this philosophically derived claim of a second, constellatory mode of thinking.

Under the heading of “dual-process accounts”, but also under some other headings there seems to exist an interesting debate that points in a somewhat similar direction (see Literature). In this debate the point of departure are empirical observations of how the human brain actually executes thinking processes. The one main position in this debate is that there should be two basic modes of thinking: An elder, preconceptual mode, referred to as “system 1”, and a much more recent, language-based, explicitly rational, and capacity-wise rather limited mode referred to as “system 2”. In terms of the basic features attributed to the two systems these findings seem to fit quite nicely with the two cognitive approaches to reality postulated here.

The arguments developed here may also explain why the elder, in my words “constellatory” mode was not replaced in toto, but why it was just complemented by the new, ratiomorphic mode. The more recent approach is a very efficient adaptation to the factual aspect of reality – but it is, for that very reason, *structurally* incapable to deal with the statu-nascendi aspect of reality. In order to cope with this, and especially the phenomena of strong selfreferentiality and autogenesis, our thinking has to draw still on the elder, constellatory mode. This constellatory mode can, however, not only be applied to pre-conceptual mental content. Once explicit concepts are available we may look also of constellations of concepts, i.e. process them in this constellatory mode. I assume that really creative and innovative thinking is characterized by the ability to switch effortlessly, seamlessly and frequently between these two modes of thinking.

But even without this specific skill to process entire constellation of concepts in a constellatory mode, the two modes of human thinking are irreducibly interwoven, even in basic thinking operations. Given the most fundamental architecture of neurons and networks of neurons the constellatory mode seems to be much closer to the underlying, neurobiological “hardware”. Due to their very structure, neurons “throw together” many heterogeneous inputs and “reduce” this richness into a much simpler output, their firing frequency. Neural networks seem optimally predisposed for “associative learning”, which turns out to be a form of constellatory processing.

Ratiomorphic reasoning, instead, constitutes a rather remote possibility to use biological neural networks. Probably several “windows of opportunity” had incidentally

to be open at the same time in order to allow for its initial development.<sup>1</sup> Otherwise many more species should have profited massively from its spontaneous development. Compared to the underlying neurobiological machinery it seems almost a bit like dressage in horse riding: horses can walk diagonally backward, but it comes by no means naturally to them.

Listing the features of each of these two modes of thinking we immediately see their respective strength and weaknesses:

	Ratiomorphic	Constellatory
content	well-defined (at least asymptotically)	meaning unfolds
formalization	possible	impossible
place-holding (formalization)	possible	impossible
proves	mandatory, coercive	up to acceptance
truth criterion	formal correctness	authentic experience
predication	either / or	paratactic
observation	detached / external	integral part / from within
conclusions	possible	impossible
(authentic) experience	not necessary	constitutive
embodiment	optional	irreducible
aspect of time	linear-sequential	expanded present
logic	Boolean	nonboolean with dynamics of constellatory unfolding

But arguing for this fundamental complementarity of the two thinking modes, a additional question arises. Why has the ratiomorphic mode attracted almost all attention in our thinking about thought – just think about the use of the notion of logic ever since Aristotle – and the constellatory to little?

The answer could be that the ratiomorphic mode is inherently affine to the search for precise explanations drawing on well-defined distinctions and concepts, and hence the dramatic overrepresentation. Only once we learned that reality itself is not comprehensively well-defined (with this proposition I am, in a way, just paraphrasing Heisenberg’s “uncertainty principle”) we were forced to wonder what and how to think about reality itself. It then took actually several decades until it dawned to us (a) to which extent also all theories of modern physics are grounded on categorial foundations, (b) that these categories are not isolated entities but that they form closely interrelated apparatus, and (c) that these underlying categorial apparatus have to become an integral part of our physical theories in order to understand the specifics of the quantum physical take on reality, and in order to come – derivatively – to grips with its relation to general relativity.

<sup>1</sup>Once developed, presumably several strong positive selection mechanisms kicked in and this explains the – in evolutionary terms – extremely rapid development of advanced cognitive skills based on syntactic language and conceptual hierarchies. As this allowed also for the “outsourcing” of cognitive evolution into modular cultural artifacts, the whole process started to accelerate itself even further – and we got, so to speak, from throwing bones to throwing bombs in just a blink.

Heisenberg's claim that the advent of quantum physics was the most significant event in twentieth century philosophy is probably correct – one just might state it somewhat more modestly and adequately as “gave rise to”. Quantum physics itself found ingenious ways how to *handle* the statu-nascendi aspect of reality mathematically – but, it did not really *understand* what it was doing.

The statu-nascendi aspect of reality is, as we saw, inseparably linked to the principle of uncertainty respectively the phenomenon of objective indeterminacy and genuine novelty. They all imply that in a phase-space portrait of the “state of affairs” ex ante there remains a certain, irreducible *volume* out of which several different trajectories can emerge. Only time can tell which of these options actually materializes – which implies both, strong temporality and an “objective role” for the present in physics. The incompressibility of this volume is the footprint of objective indeterminacy.

This means also that our ex-ante ignorance is not a matter of lacking knowledge; the situation is “objectively” undecided, i.e. there is nothing that could be known. In order to cope with such a setting of “objective indeterminacy” constellatory logic comes very handy. The best we can do in such a situation is to look at the entire ensemble of components (in this case options), and their specific constellation. Given objective indeterminacy, this constellatory approach is much more appropriate than arbitrarily picking out one possibility and treating it with Boolean rigidity.<sup>2</sup>

All we can build-on, as long as reality is still “underdefined”, i.e. still in statu-nascendi, are *constellations of options, respectively components or features*. By looking at them in the specific configuration they can “shed light on each other”, i.e. mutually interpret their meaning. Confronted with such an underdefined, “objectively uncertain” situation, our cognition tries to make sense of the specific constellation of components. Traditionally this way of thinking (i.e. of linking mental content) has often been called “intuition”, or “intuitive thinking” or “(gut) feeling”. In not being easy to verbalize it is closely related also to (implicit) emotional and esthetic assessments.

The challenge for a logic of constellations is to address and represent, respectively approximate and mimic this unfolding. In trying this two characteristics need to be avoided: well-definedness (as it would curb the dynamics) and “everything goes” (as this would be equivalent to the “ex falso-quodlibet” catastrophe, and, in addition, it would make the notion of rules or principles superfluous in the first place).

The logic of constellations that I am proposing tries to avoid both traps by introducing the three mentioned principles of “semantic unfolding”. But it should be stressed again, that this does not give us back the rigid truth criteria of classical logic. Instead, both, the authentic presence of the semantic content in the respective constellation is needed (i.e. no place-holding is possible which is inherent in all

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<sup>2</sup>In treating this objective indeterminacy mathematically one has the huge advantage of putting all that can be said in a seemingly well-defined formalism, the development of the probability function, which is fully deterministic and time-reversible. Yet, one keeps the “real” ontological meaning absolutely open – by cramming all the uncertainty in the unsuspecting use of complex numbers. This mathematical ‘trick’ is very elegant and powerful, but – by offering a somewhat misleading “quasi-classicality” – it also contributed to hiding the radical break of quantum physics with the classical / factual notions of time and reality.

efforts to formalize) and the authentic experience of the unfolding of meaning are required (that is the reason why “summarizing” a poem does not work.) Authentic experience is the only and ultimate criterion of truth in a logic of constellations.

In the western occidental cultural tradition a split occurred which separated “science” – as the realm of well-defined accounts – from “art” – as the realm for which the autogenetic unfolding of meaning out of constellations is characteristic. Seen from the conceptual framework developed here, too radical a rift between these two is rather unfortunate. It hides the phenomenon that reality itself has both aspects to it, and thus requires both modes of cognition to be used in a complementary, not in a separated and dichotomized way. Only by using the two modes of thinking in their complementary way we can regain access to something that got more and more marginalized during the development of modern science and technology: the co-perception of what I would call “the objective wonderfulness of reality.”

In this sense, constellatory thinking operations may still today play the dominant role in three domains of advanced cognition: (1) creativity and intuition, the latter also as an accompanying factor of profound expertise, (2) the whole realm of arts, and (3) for the experience of meaning and sense in our lives. Obviously, constellatory reasoning can be and usually is, in all three cases, massively and widely interwoven with ratiomorphic components of thinking. But that does not deny its predominance in these domains of advanced human cognition.

An account of reality that – in a self-immunizing way – focuses more and more on the well-defined aspects of reality amounts at the end to a mental and cultural situation that could be described as a “facticity imprisonment”. For Midas everything he touched turned into gold, according to his own wish. At the end, this led to his death by starvation. Today we are in a comparable situation: in order to accept something as real we require it to be factual – and thus we become more and more deprived of the copercption of the genuine openness, and, thus “wonderfulness” of reality. One could even argue that the contemporary predominance of the paradigm of “power, possession and control”, is the futile effort to compensate for this strongly felt, but hardly understood cognitive deficit.

Summing up, the punch line of the argument is that human thinking may be characterized by two complementary modes of linking mental content:

- In phylogenetic terms, a rather late, ratiomorphic reasoning which is based on (asymptotically) well-defined or well-definable operations that are also relatively easy to verbalize. The logical core of this mode of reasoning is Boolean logic (which turns out to be also the indispensable meta-logic of all so-called many-value, modal or temporal logics).
- The phylogenetically elder, but through the course of cognitive evolution also increasingly sophisticated mode of “constellatory logic”. Being initially clearly preconceptual, this mode of linking mental content is reutilized again on the level of concept-based thinking. Good examples for this are esthetic or “intuitive” judgments. Even if applied on the level of conceptual thinking, the constellatory

operations are still constitutively not well-defined and are, therefore, not formalizable. This is the inevitable price that has to be paid for being able to address strongly self-referential and autogenetic phenomena, i.e. the *statu-nascendi* aspect of reality.<sup>1</sup> In the history of philosophy there are two – rather controversial – thinkers whose thinking was essentially based on a much richer understanding of “logic”, Heraclites and Hegel. One can, however, read almost the entire history of philosophy under the aspect how a complementarity of thinking modes is alluded to, at least implicitly.

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<sup>1</sup>A final remark on further literature: It would have been beyond the scope of this paper - and, even more so, beyond my limited competences - to systematically introduce and discuss the many approaches to “complementary modes of thinking” that exist in the history of philosophy and, more recently, in cognitive science. Even a not too detailed overview would probably require a book of its own. From the history of philosophy I would just like to mention three – rather controversial - thinkers whose thinking was essentially based on a much richer understanding of the notion of “logic”, Heraclites, Hegel and Heidegger. One can, however, read almost the entire history of philosophy under the aspect how a complementarity of thinking modes was alluded to, explicitly or implicitly. Regarding modern “dual-processing” accounts see for an interesting overview Evans, J.St.B.T. (2003): In two minds – dual-processing accounts of reasoning. *TRENDS in Cognitive Sciences* Vol. 7 No. 10 and more recently Evans, J.St.B.T. (2008): Dual-Processing Accounts of Reasoning, Judgement and Social Cognition. *Annual Review of Psychology* 59, 255-278. Very interesting and relevant contributions to the issue have been provided also by Vinod Goel (see: Goel, V. (1995): *Sketches of thought*. Cambridge, MA: MIT Press; Vartanian, O. & Goel, V. (2004): Neuroanatomical correlates of aesthetic preference for paintings. *NeuroReport*, Vol. 15, No. 5, pp. 893-897; Vartanian, O. & Goel, V. (2005): Neural Correlates of Creative Cognition. In: C. Martindale, P. Locher, & V. Petrov (Eds.), *Evolutionary and neuro-cognitive approaches to the arts*. Baywood Publishing; Goel, V., Buchel, C., Frith, C., Dolan, R. (2000): Dissociation of Mechanisms Underlying Syllogistic Reasoning. *NeuroImage*, Vol. 12, No. 5, pp. 504-514). Regarding the claim of two complementary categorial apparatus and their correspondence to the factual and the *statu-nascendi* aspect of reality see: von Müller, A.A.C (1983): *Zeit und Logik*. Wissenschaftszentrum München (ed.), Wolfgang Bauer Verlag, Munich and more recently Filk, T. & von Müller, A. (2009): *Quantum Physics and Consciousness: The Quest for a Common Conceptual Foundation*. *Mind and Matter* 7/1, 59-80.